

The Listing of the Claims

1. (Previously Presented) A method for manufacturing a diamond film comprising:
forming a plasma of finite volume near a substrate by subjecting a gas containing at least hydrogen and carbon in a vacuum chamber to periodic pulsed discharges using a pulsed microwave plasma by applying only a repeated succession of a low-power state and a high-power state, in which the ratio of the duration of the high-power state to the duration of the low-power state is between 1/9 and 1, and having a peak absorbed power P_c , so as to obtain at least carbon-containing radicals in the plasma, and depositing the said carbon-containing radicals on the substrate in order to form a diamond film thereon;
wherein the power being injected into the volume of the plasma with a peak power density of at least 100 W/cm^3 while maintaining the substrate to a substrate temperature of between 700°C and 1000°C , and also wherein the pressure of the plasma is maintained between 100 mbar and 350 mbar.
2. (Previously Presented) The method according to Claim 1, in which a plasma having at least one of the following features is generated near the substrate:
 - the peak power density of the plasma is between 100 W/cm^3 and 250 W/cm^3 ,
 - the maximum temperature of the plasma is between 3500 K and 5000 K,
 - the temperature of the plasma in a boundary region of the plasma located less than 1 cm from the surface of the substrate is between 1500 K and 3000 K and
 - the plasma contains hydrogen atoms having a maximum concentration in the plasma of between 1.7×10^{16} and $5 \times 10^{17} \text{ cm}^{-3}$.
3. (Previously Presented) The method according to Claim 1 or Claim 2, in which said gas contains carbon and hydrogen in a carbon/hydrogen molar ratio of between 1% and 12%.

4. (Previously Presented) The method according to Claim 1, in which said gas contains at least one hydro-carbon, and a plasma having a concentration of the carbon-containing radicals of between $2 \times 10^{14} \text{ cm}^{-3}$ and $1 \times 10^{15} \text{ cm}^{-3}$ is generated.

5. (Cancelled)

6. (Previously Presented) The method according to Claim 1, in which at least one of the following parameters is estimated:

- a substrate temperature,
- a temperature of the plasma,
- a temperature of the plasma in said boundary region, located less than 1 cm from the surface of the substrate,
- a concentration of atomic hydrogen in the plasma,
- a concentration of carbon-containing radicals in the plasma,
- a concentration of carbon-containing radicals in said boundary region close to the plasma,
- a pressure of the plasma and
- a power density of the plasma,

and the power emitted as a function of time is adapted according to at least one of these parameters.

7. (Previously Presented) The method according to Claim 1, in which the plasma is contained in a cavity with at least one of the following properties:

- the periodic pulsed discharges have a peak power of at least 5 kW at 2.45 GHz and
- the gas containing hydrogen and carbon is emitted with a ration of the flow rate to

the volume of plasma of between 0.75 and 7.5 sccm/cm³.

8. (Previously Presented) The method according to Claim 1, in which the plasma is contained in a cavity with at least one of the following properties:

- the periodic pulsed discharges have a peak power of at least 10 kW at 915 MHz

and

- the gas containing hydrogen and carbon is emitted with a ratio of the flow rate to the volume of the plasma of between 0.75 and 7.5 sccm/cm³.